

Compatibility of Contemporary Physical Theory with Personality Survival.

Henry P. Stapp
Theoretical Physics Group
Lawrence Berkeley National Laboratory
University of California
Berkeley, California 94705

Abstract

Orthodox quantum mechanics is technically built around an element that von Neumann called Process 1. In its basic form it consists of an action that reduces the prior state of a physical system to a sum of two parts, which can be regarded as the parts corresponding to the answers 'Yes' and 'No' to a specific question that this action poses, or 'puts to nature'. Nature returns one answer or the other, in accordance with statistical weightings specified by the theory. Thus the standard statistical element in quantum theory enters only after the Process-1 choice is made, while the known deterministic element in quantum theory governs the dynamics that prevails between the reduction events, but not the process that determines which of the continuum of allowed Process-1 probing actions will actually occur. The rules governing that selection process are not fixed by the theory in its present form. This freedom can be used to resolve in a natural way an apparent problem of the orthodox theory, its biocentrism. That resolution produces a rationally coherent realization of the theory that preserves the basic orthodox structure but allows naturally

for the possibility that human personality may survive bodily death.

Introduction

Reports of evidence for survival of personality after bodily death have long been viewed with great skepticism by most of the scientific community, including this author. But, in contrast to the doubters who refused to look through Galileo's telescope, I have, in spite of my skepticism, perused certain documentations of such claims that have been brought insistently to my attention by scientists judged by me to be intelligent, critical, and sober-minded.

One such document was particularly arresting. It is the book *Irreducible Mind*, written by Edward and Emily Kelly and several other scientists personally known to me. While insufficient to quell my life-long doubts, this account has rendered reasonable the task of examining whether the phenomena in question, if *assumed* to be veridical, could be reconciled with contemporary physical theory in a natural and reasonable way.

The very term "contemporary physical theory" raises a problem. It means, above all, quantum mechanics. But "quantum mechanics" is understood in diverse ways even by highly respected scientists, and in a vast array of disparate ways by many others. Within this grand collection of putative interpretations there would undoubtedly be no difficulty in finding some outlandish conception of quantum mechanics that would accommodate even the wildest of assumptions about the nature of reality.

On the other hand, there is one conservative and rationally coherent conception of quantum mechanics that in my opinion

stands out from all others. It is the one that I, following the lead of Eugene Wigner, call the “orthodox” interpretation. It is based primarily upon the development and formalization of the original Copenhagen version of quantum mechanics achieved by the logician and mathematician John von Neumann, fortified by the ontological ideas of Werner Heisenberg, by the mathematical contributions of Sin-itiro Tomonaga and Julian Schwinger, and by the philosophical and psychological insights of William James. I have described this ‘orthodox’ quantum theory at length in two books (Stapp 2007, 2009) and many papers (www-physics.lbl.gov/~stapp/stappfiles.html). It is therefore reasonably well defined, and is deeply rooted in solid mathematical works of extremely reputable scientists. There has been no hint in my previous descriptions (or conception) of this orthodox quantum mechanics of any notion of personality survival.

Orthodox quantum mechanics, like Copenhagen quantum mechanics, is based on the notion of ‘reductions’, or ‘collapses’, of the quantum state. Heisenberg introduced the Aristotelian concept of “potentia”, and regarded the quantum mechanical state of a system to be not only a compendium of knowledge about what has happened in the past, but also a “potentia”---an objective tendency---for this evolving quantum state to abruptly collapse to a reduced part of itself. These reductions are needed to keep cutting back the *otherwise expanding continuum* of possibilities created by the Schroedinger-equation-based temporal evolution of the quantum state to the part of itself that is compatible with our collective human experience.

The mathematical form of this reduction process was specified by von Neumann (1932). It has two logically distinct steps. The first was called by von Neumann “Process 1”. It consists, in its most basic form, of a localized action upon the quantum state that can be regarded as posing a local question that can be answered either ‘Yes’ or ‘No’. All localized aspects of the state that do not

correspond to either a definite ‘Yes’ or a definite ‘No’ are eliminated from the state by this Process 1 action, which is accompanied in principle by an associated increment of knowledge. Because the quantum state is represented by a (density) matrix, which has two sides, and because a definite ‘Yes’ requires a ‘Yes’ condition on both sides, and similarly for a definite ‘No’, the Process 1 action that reduces the state to a definite ‘Yes’ part plus a definite ‘No’ part is a nontrivial action: it eliminates the parts of the prior state that satisfy the ‘Yes’ condition on one side and the ‘No’ condition on the other side.

Once this clean separation is made, the second stage can proceed in an automatic and mathematically prescribed way. Definite statistical weights can be assigned to the two alternative possibilities. These weights are interpreted in terms of propensities ---objective tendencies---for these two events to occur. Massive empirical evidence supports this assignment of statistical weights: quantum mechanics works exceedingly well!

A key conceptual point is that the statistical element enters logically into the quantum dynamics *only after* the Process-1 choice of probing action has been made. Furthermore, the deterministic element of the quantum dynamics enters the dynamics only via the Schroedinger equation, which controls the evolution *between* the reduction events. The choice of the actually occurring Process-1 action is not specified, either deterministically or statistically, by any yet-known law or rule: it remains, *in this specific sense*, a “free choice”. The origin and nature of this choice constitutes a huge causal gap in the orthodox theory, as it stands today. The form of the rules governing this choice is the one thing that needs to be specified in more detail in order to render orthodox quantum mechanics better defined.

The purpose of the present communication is to alert scientists to the fact that the nature of the Process-1 choice can be understood

in a very natural and reasonable way that allows quantum mechanics to automatically accommodate phenomena of the kind in question.

From Copenhagen to Orthodox

According to the atomic hypothesis, large physical objects are composed of atomic constituents, and the behaviors and properties of these large things should be a natural consequence of the behaviors and properties of their atomic parts

In order to put the mathematical features of quantum mechanics to work in a practically useful---yet rationally coherent---way, scientists needed to allow the quantum mathematical concepts to rule in the microscopic domain, yet allow large visible objects to behave in ways concordant with our everyday empirical observations. In order to achieve this result, the founders of quantum theory proposed a rather odd procedure. They required the scientist to cut the physically unified world into two parts, and to describe these parts in two mathematically different ways. Below the cut one uses the quantum mathematical description, but above the cut one uses the classical mathematical description, constrained at each moment of observation to what is empirically experienced.

At the beginning of an experiment the experimenter, acting for certain reasons, sets up the initial conditions. His actions are conceived of in terms of the physical arrangements of various pieces of apparatus. These he can describe to himself, and to other trained scientists, in terms of the concepts of classical physics. According to these concepts, each observable and manipulatable part of the apparatus occupies at each instant some fixed region of space. His manipulations and observations, in combination with the quantum rules connecting the classically conceivable aspects of the empirical situation to the quantum mechanically conceived

aspects, allow the quantum system below the cut to be represented by some particular quantum state (i.e., density matrix). He then allows the quantum dynamical rules to govern the evolution of the system below the cut until the time of the later observation. At this later time one generally finds that the evolved state of the system below the cut cannot be matched to any conceivable classical description of the properties visible to observers. In order to use the theory the experimenter must now choose some *particular* property of the quantum system that he wants find out about, and then, by again using certain rules and ideas relating observable classically describable properties to quantum mechanically described properties, act to set up an apparatus that will signal, by an observable response, whether or not the particular property holds.

This process of setting in place the appropriate probing device and subjecting the system being probed to this probing action has, according to the rules of quantum mechanics, the effect upon the (evolved) density matrix of the probed system that von Neumann calls Process 1. Once this action is made, there are further rules that can be invoked to produce a statistical prediction for the probability that the selected property will be empirically observed. Thus Process 1 represents, within the physically described system below the cut, the effect there of a complex process occurring above the cut, namely the physical process above the cut that stems from the experimenter's choice of which property of the system below the cut he elects to probe.

That the founders of quantum mechanics were able to sell this peculiar idea to the physics community might seem incredible. But the founders held the clincher: it worked! Moreover, this pragmatic scheme was soon incorporated, by the work of John von Neumann, into a reasonable and ontologically interpretable understanding of nature.

The founders had often emphasized that the cut could be shifted, within limits, without changing the predictions of the theory. Bohr gave the example of a blind man with a cane: when the cane is held loosely, the boundary between the person and the external world is the divide between hand and cane; but when held tightly the cane becomes part of the probing self: the person feels that he himself extends to the tip of the cane.

Von Neumann rigorized these ideas, and moved the cut, step by step, up to, and then into, the body of the observer, without altering the predictions---which continue to reside in the mind of the experimenter/observer---until at last the entire physical body of the observer; and of all observers; and of all else that is regarded as ‘physical’, are shifted to below the cut, and described in terms of the quantum mathematics. The probing and observing *psyche* of the experimenter/observer is thereby shifted completely outside the physically described world. Yet von Neumann’s laws of *interaction* between the two realms remained intact. Hence the residents of these disparate domains become dynamically linked, producing an ontology akin to Descartes’ psycho-physical dualism.

But the mental and physical aspects are not two independent Cartesian *substances*, each completely sufficient unto itself. On the physical side, the quantum temporal evolution proceeds in discrete steps, with an interval of continuous expansion of an array of possibilities for the occurrence of an “actual event”, followed by an actual event that reduces this array to the subset compatible with a specific “experience”. On the mental side, according to William James (1911, p. 155): “Your acquaintance with reality grows literally by buds or drops of perception. Intellectually and upon reflection you can divide these into components, but as immediately given they come totally or not at all.”

Ontologically construed orthodox quantum mechanics, as I understand it, involves passing from the purely pragmatic Copenhagen stance to the position of trying to take seriously and ontologically the mathematical structure of quantum mechanics, and in particular the idea of psycho-physical events whose mental aspects are drops of experience and whose physical aspects are corresponding physical reductions. According to this viewpoint, physical objects are persisting societies of sequences of physical events, while personalities are persisting societies of mental events. Linkages between events of these differently described kinds are created by the psycho-physical reduction events, which are needed to cut back the Schroedinger-equation-generated evolution of the physically described aspects of nature to a form compatible with the reality of human experience.

Insofar as the consequences of the psycho-physical reduction event depend *jointly* upon the mental and physical inputs into the event, the physical world is no longer dynamically closed, as it was in classical physics. And insofar as the mental and physical components are linked by indivisible psycho-physical events, these elements are conceptually entangled. In short, the mentally described and physically described aspects of this theoretical understanding of nature are both dynamically and conceptually entangled in a way that was opened up by the replacement of the mathematical structure of classical physics, which entailed complete physical determinism, by that of quantum physics, which does not entail complete physical determinism.

A Problem With Orthodox Quantum Mechanics.

The quantum explanation of how our minds and brains can be both ontologically different, yet dynamically connected by the orthodox laws of physics, is a welcome revelation. It solves a problem that has plagued both science and philosophy for centuries---the

imagined science-mandated need either to equate mind with brain, or to make the brain dynamically independent of the mind. The detailed form of the orthodox laws provides, moreover, a completely natural way to account for the power of our conscious intentional efforts to influence our bodily actions in the way that we consciously intend (Schwartz, et al., 2005; Stapp, 2001, 2007, 2009).

But the theory, as described so far, has one flaw: it is anthropocentric! The Copenhagen quantum mechanics from which orthodox quantum mechanics arose was a practical theory meant to be used by scientists in their scientific studies of nature. Consequently, the physically described collapses could be assumed to occur only in association with *human* experiences. Then each pertinent collapse is a psycho-physical event; it is a pair of events, with one event of the pair occurring in someone's stream of consciousness, and the paired physical event occurring in that person's brain. However, von Neumann's analysis shows that analogous collapses could be occurring in association with every macroscopic organism without appreciably disrupting those predictions of the theory that pertain to human experiences. But even if we do resolve the issue of anthropocentrism in this way, by supposing that collapses can occur in connection with all life forms, there is still a residual problem: biocentrism! There would be in principle a fundamental dependence of the process of cosmic evolution on the presence of life. Yet the boundary between life and non-life is probably not completely sharp.

One possible resolution is to imagine that even before life, or anything reasonably resembling life, there were localized physical structures around that could support something dimly resembling our conscious experiences, and that "psycho-physical" collapse events were occurring in association with those physical structures. This solution is called panpsychism, which comes in many variations. But it is rather difficult to conceive how anything even

remotely resembling human consciousness could exist in the very early universe. And the idea that the thermostat that regulates the temperature in your house is even vaguely aware of what it is doing certainly goes against “common sense”.

A Natural Resolution.

The central idea of ontologically construed orthodox quantum mechanics is that the disparate worlds of mind and matter are linked together in reality in essentially the very way that they are linked together in quantum theory, namely by psycho-physical events the dynamics of which are beyond and outside the scope of what can be described in purely physical terms. Because these psycho-physical events are so central to the theory it is rather unnatural and seemingly retrograde even to consider the possible existence of events that are not psycho-physical in character.

Nevertheless a solution of the biocentrism problem that is more commonsensical than panpsychism is to allow Process-1 actions that are not psycho-physical---i.e., to allow *some* reduction events to lack mental aspects altogether. This solution would permit some reduction events to occur by virtue of sufficient physical conditions alone, and to contain no localized mental aspect at all.

Permitting, under certain physical conditions, purely physical kinds of Process-1 actions does not in any way curtail the need for the existence, in the quantum world in which we human beings live, of the psycho-physical-type Process-1 actions. These actions are essential---within orthodox quantum mechanics---both for the conduct of our consciously informed and controlled lives, and for the linkage between physical theory and empirical data that constitutes the basis of the tests and applications of quantum mechanics.

This allowing of societies of physical events to hang together by virtue of physical connections alone raises the natural next question as to whether societies of mental events could hang together by virtue of *mental* connections alone.

Space, Time, and Relativity.

Before proceeding to the main argument, one other relevant matter needs to be addressed.

Von Neumann recognized one deficiency of his treatment: it failed to accord with the ideas of the special theory of relativity. In his treatment, each possible physical state of the universe represents the physical aspects of the universe at one single instant of time. This time is defined in some favored coordinate system: each reduction occurs over all of space at some particular instant of time in this favored coordinate system. This dependence of physical behavior upon a favored coordinate system conflicts with Einstein's idea that no coordinate frame is favored over any other.

Einstein's idea rests squarely on the precepts of classical physics, in which the deterministic laws entail that the entire history of the universe is fixed already at the outset. This gives a 4-dimensional "block universe". There is no essential coming into being. Each perceptual experience is considered to be merely a recognition, from some particular vantage point in space-time, of the pre-existing physical reality. The notion that your conscious efforts at this moment are influencing what is about to happen to you becomes, within the block universe, an illusion: the whole course of reality was fixed and settled long before you were born, and, indeed, long before life itself emerged.

The incompatibility of von Neumann's original formulation with Einstein's ideas has led some physicists to a block-universe understanding of quantum theory, in which there is no fundamental coming into being of the physical facts, but only piecemeal perceptions (of a pre-existing physical reality) that are pre-determined to appear to conform to the quantum statistical rules.

However, in the middle of the twentieth century, Tomonaga (1946) and Schwinger (1951) converted von Neumann's formulation to relativistic form. The fixed-time surfaces upon which the physical states were defined became flexible surfaces that depend upon no favored coordinate system. Each quantum event became associated with a *localized* forward shift of the surface upon which the physical state is defined, instead of a wholesale global shift to a new time. [See diagram 13.1 in Stapp 2007, p. 92.] Each Process-1 action is *localized* in the sense that this action changes potentialities only in this local region. But nature's response is global, in the sense that if two separated regions contain the two parts of an entangled system then nature's response to a Process-1 action in one region can "instantly" change potentialities in the other region. Nevertheless, in the Tomonaga/Schwinger relativistic theory all empirical predictions conform to the empirical demands of special relativity. This relativistic generalization of von Neumann's theory is (Tomonaga/Schwinger) relativistic quantum field theory: RQFT.

The upshot is that the "block-universe" conception of nature can be replaced by an "unfolding-universe" conception in which what is about to happen is *uncertain* until it actually happens, and what actually happens can depend *jointly* upon both the mental and physical aspects of what precedes it.

The space-time and causal aspects of quantum theory brought out in this section have been explained in detail elsewhere (Stapp,

2007). The brief summary given here is meant merely to provide a general background for the key point that follows.

The Character of the Reduction Events of Orthodox Quantum Theory.

The focus of Copenhagen quantum mechanics on practical applications led to the characterization of the needed reduction events as inherently psycho-physical: each increment in ‘our knowledge’ was mated with a reduction of the quantum state that eliminated all physical components incompatible with our new knowledge. This Copenhagen notion of the psycho-physical character of the reduction events was carried over by von Neumann and others into orthodox quantum theory, with its emphasis on reduction events as the basis of the mind-brain connection. But, as argued in an earlier section, a natural resolution of the problem of biocentrism leads to a relaxing of the notion that *all* reduction events must be psycho-physical events possessing both mental and physical components. That natural resolution of the biocentrism problem is to allow, in addition to the psycho-physical reduction events that dynamically connect our human thoughts to the physically described world around us, reduction events that involve only physical properties. Indeed, William James (1892, p. 227) proposed that, even under normal human-based conditions, our attention is initially caught by a process with purely physical inputs, and is only thereafter influenced by mental inputs. This idea has long been a key element in the development of the orthodox interpretation that I have been pursuing (Stapp, 2001, 2009, p. 227).

An analogous possibility exists on the mental side. William James (1890, p.3) drew attention to “the fantastic laws of clinging” that

allow a stream of conscious thoughts, with its ever-changing intermingling of related ideas, to hang together like a persisting entity. If there were purely mentalistic laws of clinging, then in our normal streams of consciousness these mentalistic laws could be acting in coordination with the physical laws of clinging, to produce the coordinated streams of consciousness that we experience. But how seriously would the theory be upset if sequences of mental events could hang together in persisting societies without the assistance of their physical mates?

When one gets involved with these metaphysical issues that seem to go far beyond the verifiable practical applications of our scientific theories, we are confronted with the question of what determined the form of the laws that seem now to prevail. A naturalistic solution, suggested by the process of natural selection that has brought into being the presently existing life forms, is that the physical laws of nature themselves were honed into their present forms by some analogous process of selection. If we can push back to a time when only one or the other aspect prevailed, then it is certainly much easier to imagine a basically mental world creating for itself a physical substructure to attend to the minor details, than to imagine a purely physical world creating a mental superstructure. For we ourselves, in our mental theorizing, can readily dream up mathematical laws, but no one has yet been able to explain how consciousness could emerge from mindless matter.

This line of thought suggests that the mental laws of clinging could be the more basic, and that they could create the physical aspects to assist in whatever creative endeavor is afoot. But in any case, I have not found any fundamental theoretical reason to rule out the possibility that societies of mental events could be held together by purely mental laws of clinging. Nor is there any empirical reason, insofar as one allows for the possible existence of rogue phenomena of the general kinds described in the book of Kelly et. al.

If the reduction events need not *always* be dual in character, but can sometimes be purely mental or purely physical, and if events of each pure kind can, under appropriate conditions, cling together by virtue of their own dynamical laws, then it would seemingly become possible for the mental and physical aspects of a living person to go their separate ways upon the death of the physical body. For that fatal event would cause the disintegration of the physical properties that normally allow the brain events to hang together with the mental ones.

Because the psycho-physical events associated with bio-systems are designed to receive mental inputs that are properly mated to the physical event selected at this psycho-physical event, a disembodied personality could perhaps latch onto a bio-system and thereby affect the physical world. This would produce effects greatly at odds with what classical physics would allow. For it would allow some aspect of personality associated with a deceased person to affect, without any physical means of conveyance, the subsequent behavior of a living person. That would contravene the precepts of classical physics. But if societies of mental events could indeed persist without physical aspects, then such effects would not seem to require any basic change of the known laws of quantum physics.

In summary, the central point of this paper is merely to point out that the elaboration of orthodox quantum mechanics that achieves the most commonsensical solution to the biocentrism problem parallels an elaboration that naturally accommodates personality survival. Neither of these elaborations appears to require any basic change in the orthodox theory. But both require a relaxing of the idea that physical and mental events occur only when paired together.

In light of these considerations, strong doubts about personality survival based *solely* on the belief that postmortem survival is incompatible with the laws of physics are unfounded. Rational science-based opinion on this question must be based on the content and quality of the empirical data, not on a presumed incompatibility of such phenomena with our contemporary understanding of the workings of nature.

Acknowledgement. This paper has benefited greatly from many important suggestions from Edward F. Kelly.

References

- Bohr, N. (1963). *Essays 1958/1962 on Atomic Physics and Human Knowledge*. Wiley, New York, US.
- Heisenberg, W. (1958). *Physics and Philosophy*. Harper, New York, US.
- James, W. (1890). *Principles of Psychology*. Dover, New York, US.
- James, W. (1892). *Psychology: The Briefer Course*. In William James: *Writings 1878-1899*. Library of America, Literary Classics of the United States, Inc. (1992), New York, US
- James, W. (1911). *Some Problems in Philosophy: A Beginning of an Introduction to Philosophy*. Chapter X. *Novelty and the Infinite---The Conceptual View*. Longmans, Green and Co., London. UK. (1940). Also in, *William James: Writings 1902-1910*. Library of America, Literary Classics of the United States, Inc., New York, US. (1987), p.1061.

Kelly, E., Kelly, E., Crabtree A., Gauld A., Grosso, M. & Greyson, B. (2007). *Irreducible Mind: Toward A Psychology For The 21st Century*, Rowman and Littlefield, Lanham, Maryland, US.

Schwartz, J, Stapp H., and Beauregard M., (2005). Quantum theory in neuroscience and psychology: a neurophysical model of the mind/brain connection. *Phil. Trans, Royal Society, B* 360(1458) 1309-27 92005).

Schwinger, J. (1951). Theory of Quantized Fields 1. *Physical Review*, 82, 914-927.

Stapp, H.P. (2001). Quantum mechanics and the role of mind in nature. *Foundations of Physics*, 31, 1465-1499. (www-physics.lbl.gov/~stapp/vnr.pdf)

Stapp, H.P. (2005). Quantum interactive dualism: an alternative to materialism. *J. Consc. Studies*, 12, 43-58.

Stapp, H.P., (1993/2004/2009) *Mind, Matter, and Quantum Mechanics*. Springer. Berlin, Heidelberg, New York, US.

Stapp, H.P. (2007). *Mindful Universe: Quantum Mechanics and the Participating Observer*. Springer, Berlin, Heidelberg, New York, US.

Tomonaga, S. (1946). On a relativistically invariant formulation of the quantum theory of wave fields. *Progress of Theoretical Physics*, 1, 27-42.

Von Neumann, J. (1955/1932). *Mathematical Foundations of Quantum Mechanics*. Princeton University Press, Princeton

New Jersey, US. (Translation of the German original:
Mathematische Grundlagen der Quantenmechanik, Springer,
Berlin, 1932.)